The reviewer appreciated substantial amount of data, the reader-friendly presentation by using a clear text structure and good statistical techniques. He/she issued the following minor suggestions.

-*Abstract: I would propose to either replace the final sentence, or add another one, something along the lines of line 510-512 (conclusions) to create an ending that is a bit more general*. We agree and added "The decrease of DOC and metal delivery to small rivers and lakes by peat soil leachate may also decrease the overall export of dissolved components from continuous permafrost zone to the Arctic Ocean"

- *line 101: you here write that the precipitation gradient is from 400 to 460 mm but in Table 1 it ranges between 363 and 594 mm?* We corrected as "The annual precipitation ranges from 600 mm in Kogalym to 360 mm in Tazovsky".

-*is it possible to add one-two lines on the difference in origin for the two micro-landscapes you sketch out in Figure 2?* The initial bog with weakly pronounced micro-relief was subjected to freezing during Subboreal period (~ 4500 y.a). During Subatlantic period (2500 y.a.) and the increase of temperature and precipitation, the thermokarst started. The hollows received sufficient water and they started to thaw, whereas the mounds were rising due to ice wedges underneath (Ponomareva et al., 2012; Panova et al., 2010; Pastukhov et al., 2016).

Ponomareva, O. E., Gravis, A. G., and Berdnikov, N. M.: Contemporary dynamics of frost mounds and flat peatlands in north taiga of West Siberia (on the example of Nadym site), Kriosfera Zemli, XVI, № 4, 21–30, 2012.

Pastukhov, A. V., Marchenko-Vagapova, T. I., Kaverin, D. A., and Goncharova, N. N.: Genesis and evolution of peat plateuas in the sporadic permafrost area in the European North-East (middle basin of the Kosyu river), Earth's Cryosphere, XX(1), 3–13, http://www.izdatgeo.ru/pdf/earth_cryo/2016-1/3_eng.pdf, 2016.

Panova N. K., Antipina T. G., Gilev A.V., Trofimova S. S., Zinoviev E.V., and Erokhin N. G. Holocene dynamics of vegetation and ecological conditions in the Southern Yamal Peninsula according to the results of comprehensive analysis of a relict peat bog deposit, Russ. J. Ecol., 41(1), 20–27, DOI: 10.1134/S1067413610010042, 2010.

- *section 2.2: can you add some references for this method?* The chemical composition of interstitial soil solution is known to depend on the extraction method (e.g., Geibe et al., 2006; Schlotter et al., 2012). Detailed comparison between suction cup and press techniques is described in methodological work of our group (Raudina et al., 2016)

Geibe, C.E., Danielsson, R., van Hees, P.A.W., Lundström, U.S.: Comparison of soil solution chemistry sampled by centrifugation, two types of suction lysimeters and zero-tension lysimeters, Appl. Geochem., 21(12), 2096-2111, doi: 10.1016/j.apgeochem.2006.07.010, 2006.

Raudina, T.V., Loyko, S.V., Krickov, I.V., Lim, A.G.: Comparing the composition of soil waters of West Siberian frozen mires sampled by different methods, Vestnik Tomskogo gosudarstvennogo universiteta. Biologiya – Tomsk State University Journal of Biology, 3(35), 26-42. doi: 10.17223/19988591/35/2, 2016.

Schlotter, D., Schack-Kirchner, H., Hildebrand, E.E., von Wilpert, K.: Equivalence or complementarity of soil-solution extraction methods, J. Plant Nutr. Soil Sci., 175(2), 236-244, doi: 10.1002/jpln.201000399, 2012.

- *line 147-148: how many of the analyses did not show a good agreement?* Just a few 'volatile' trace elements such as Ge, Se, Nb, Sn, Te could not be measured by quadrupole ICP MS. The analysis of these elements require totally different technique.

- *lines 215-216: did you also consider comparing latitudinal gradients for mounds only, or for hollows only (instead of the average values per site independent of topography)?* We did compare the gradient separately for hollows, and for mounds/polygons. Results of linear regression are listed in Table 3 and described in the end of section 3.3. For example, the most pronounced trend of element concentration increase northward was observed in mounds for Al (R^2 = 0.91), Sr (R^2 = 0.69), Zr (R^2 = 0.57), Ce (R^2 = 0.76), Hf (R^2 = 0.68) and Th (R^2 = 0.92). For these elements, the trend in hollows/cracks was much less pronounced or even absent, with $R^2 < 0.5$ (Table 3). A decreasing trend of element concentration northward was also better pronounced in mounds for Na, Cl, Rb, Cs and Pb.

- section 4.1: I am wondering: can the difference in DOC mounds vs. hollows also somehow be related to the (seasonal) timing of thaw? (Do the mounds thaw later than the hollows?) And hence the period of unfrozen exchange of constituents in the soil with porewater? The reviewer is totally right: the mounds do thaw later than the hollows, because the ALT deepens slower (c.a., a factor of 2) at the former. This is linked to both lower amount of heat that is delivered to the mounds with water and to stronger freezing of mounds is winter. However, the water resides longer in mounds than in hollows because the water flow rate through the hollows is a factor of 10 to 20 faster (Novikov et al., 2010).

Also, in line 379 you briefly mention that the chemical composition of peat between hollows and mounds may be different and could cause the differences in major and TE. Can this different chemical composition of peat not also play a role for the difference in DOC content between mounds and hollows? The organic carbon in peat of WSL is independent on the micro-landscape and latitude so we do not expect that chemical composition may be important here. In contrast, the peat structure, texture, hydraulic conductivity as discussed in L 288-294 certainly play very important role. Comparison of chemical composition of peat between mounds and hollows across the full latitudinal gradient goes beyond the scope of the present manuscript which is already quite long and will be a subjected of separate publication

- line 257-259: this is an interesting statement and reference, but could you elaborate a bit more on how this relates to the above two sentences? The change of SUVA from 2.4 to 3.4 in hollows demonstrates a significant shift in the composition of the DOM and may have a pronounced effect upon the biogeochemical processing of DOM upon export as it has been recently shown in Eastern Siberia (Frey et al., 2016). In the present study, statistically significant increase of $SUVA_{280}$ northward in hollows (R^2 = 0.599, see Table 3) may also indicate the lower rates of DOM processing in soils in the north, linked to either shorter residence time of soil fluids or weaker processes of photo- and bio-degradation in continuous permafrost zone compared to sporadic and discontinuous zone.

Frey, K. E., Sobczak, W. V., Mann, P. J., and Holmes, R. M.: Optical properties and bioavailability of dissolved organic matter along a flow-path continuum from soil pore waters to the Kolyma River mainstem, East Siberia, Biogeosciences, 13, 2279-2290, doi:10.5194/bg-13-2279-2016, 2016.

- line 325-328: if DOC, Fe and Al are dominating colloidal carriers, why do none of the trace elements correlate to DOC? Good point. This is also observed in river waters draining WSL peatlands. The DOC and Fe are not correlated in rivers (Pokrovsky et al., 2016a) and this is consistent with decoupling of Fe and DOC as two independent colloidal pools (high molecular weight Fe, Al-rich and low molecular weight C_{org}-rich), already demonstrated for European rivers (Neubauer et al., 2013; Vasyukova et al., 2010) and other Siberian rivers and WSL thermokarst lakes (Pokrovsky et al., 2006; Pokrovsky et al., 2011, 2016b).

Neubauer, E., Kohler, S.J., von der Kammer, F., Laudon, H., and Hofmann, T.: Effect of pH and stream order on iron and arsenic speciation in boreal catchments, Environ. Sci. Technol., 47, 7120-7128, 2013.

Pokrovsky, O. S., Shirokova, L. S., Kirpotin, S. N., Audry, S., Viers, J., and Dupré, B.: Effect of permafrost thawing on the organic carbon and metal speciation in thermokarst lakes of western Siberia, Biogeosciences, 8, 565-583, 2011.

Vasyukova, E.V., Pokrovsky, O.S., Viers, J., Oliva, P., Dupré, B., Martin, F., and Candadaup, F.: Trace elements in organic- and iron-rich surficial fluids of the boreal zone: Assessing colloidal forms via dialysis and ultrafiltration, Geochim. Cosmochim. Acta, 74, 449-468, 2010.

- lines 330-336: you present quite a lot of specific information/knowledge here, can you provide a bit better explanation so that more readers can follow? We agree and revised this paragraph as following: "There are two possible sources of "lithogenic" elements in the peat and peat porewaters: atmospheric dust deposition at the moss and lichen surface and upward migration of soil fluids that carry mineral particles from underlying loam horizons. The loam horizons are rich in silicate clay minerals (e.g., Ovchinnikov et al., 1973; Golovleva et al., 2017) that contain insoluble elements. The geochemical analysis of TE distribution in WSL peat cores across the studied permafrost gradient allowed to distinguish several categories of TE depending on their source such as soluble atmospheric aerosols, atmospheric dust, underlying mineral layers, plant biomass, surface water flooding (Stepanova et al., 2015). The atmospheric deposition of lithogenic elements in the form of soluble aerosols on the moss surfaces followed by incorporation into the peat is expected to be low as shown by thorough snow analyses across the large WSL gradient (Shevchenko et al., 2016). Therefore, atmospheric dust seems to be the main source of insoluble metals in WSL peat as it is also known from other northern bogs (Shotyk et al., 2016). Regardless of the origin of lithophile elements, we hypothesize that the leaching of insoluble trivalent and tetravalent hydrolysates (TE^{3+}, TE^{4+}) from solid phase to interstitial soil solution may be restricted by the availability of silicate clay minerals within the peat core."

Golovleva, Yu. A., Avetov, N. A., Bruand, A., Kiryushin, A. V., Tolpeshta, I. I., Krasil'nikov, P. V.: Genesis of taiga poorly differentiated soils in West Siberia, Lesovedenie, № 2, 83–93, 2017, http://lesovedenie.ru/index.php/forestry/article/view/983

Shotyk, W., Bicalho, B., Cuss, C. W., Duke, M. J. M., Noernberg, T., Pelletier, R., Steinnes, E., and Zaccone, C.: Dust is the dominant source of "heavy metals" to peat moss (*Sphagnum fuscum*) in the bogs of the Athabasca Bituminous Sands region on northern Alberta, Environ. Internat., 92-93, 494-506, 2016.

- lines 378-384: the difference in peat chemical composition is an important point, can you elaborate on this a bit more, also with respect to DOC patterns? We do not believe that the chemical composition of peat may affect the DOC level in porewaters: the peat is highly uniform in C_{org} level across the gradient and among the micro-landscapes. The organic carbon content in peat of WSL is independent on the micro-landscape and latitude (Kremenetski et al., 2003) so we do not expect that chemical composition may be a governing factor of DOC enrichment in porewaters. In contrast, the peat structure, texture, hydraulic conductivity as discussed in L 288-294 certainly play very important role. Using an analogy of ground surface and deep peat for comparison between negative and positive forms of microrelief, we suggest that the dense peat on mounds and polygons has the pores that are significantly smaller with less interconnection, which leads to more restricted flow and greater turtuosity (Rezanezhad et al., 2009, 2010, 2016). This should increase the water residence time in pores of peat in mounds relative to hollows and allow for efficient enrichment of peat porewater by DOC in the former. Comparison of chemical composition of peat between mounds and hollows across the full latitudinal gradient goes beyond the scope of the present manuscript and will be a subjected of separate publication (in progress).

- *line 440-446: this is also an interesting paragraph, that I think you can expand a bit more. E.g., what can be the consequences of the correction for general (upscaling) calculations that are now made in literature*? Today, the majority of Ca, Mg and HCO_3^- ions carried by rivers are used for calculation the CO_2 uptake flux due to chemical weathering, i.e., reaction of atmospheric CO_2 with alumosilicate and mafic minerals (Dessert et al., 2003; Beaulieu et al., 2012). Not more than 10% of total riverine flux of Ca, Mg and HCO_3 is considered to be due to atmospheric input. The present study demonstrates that in case of small rivers draining WSL frozen peatlands, such corrections should be much higher, up to 80% of total flux. The global consequence of this correction is that the continental-weathering CO_2 sink in northern peatland regions might be a factor of 2 to 4 smaller than that is currently deduced from the fluxes of large rivers.

Dessert C., Dupré B., Gaillardet J., Francois L., Allegre C.J.: Basalt weathering laws and the impact of basalt weathering on the global carbon cycle. Chem. Geol., 202, 257–273, 2003.

- *line 467-468: I do not understand why the share of spring runoff from the mounds to rivers and lakes will decrease?* Because the degradation of peat mounds and polygons will be accompanied by the spreading of hollows and depressions under on-going climate change (Pastukhov and Kaverin, 2016), the spring runoff from the mounds to rivers and lakes will decrease.

And, perhaps related to this, have you considered any future changes in precipitation patterns and/or general wetting/drying of the region? The permafrost boundary shift and the change of microlandscapes are considered to occur regardless of the change of precipitation. As a first approximation, we assume no change in precipitation, evapotranspiration and riverine runoff in the northern part of WSL (60-68°N), given that the drying trend will be pronounced only in the regions located to the south of 60°N (Alexandrov et al., 2016).

Alexandrov, G. A., Brovkin, V. A., and Kleinen, T. : The influence of climate on peatland extent in Western Siberia since the Last Glacial Maximum, Sci. Reports, 6, 24784, doi:10.1038/srep24784, 2016.

We believe that detailed analysis of the future precipitation patterns and wetting/drying regime in the WSL without taking into account the evapotranspiration by mosses and lichen is impossible and this goes beyond the scope of this manuscript.

- *line 474-476: here you present two scenarios that are presented as (i) OR (ii), but isn't it much more likely that both (i) AND (ii) will occur?* This is very good point and we thank the reviewer for pointing this out. Combining both scenario of permafrost thaw (northward permafrost boundary shift and extending the hollows over mounds) suggests that over the first decades, relatively fast permafrost coverage shift will not be accompanied by the change of micro-landscapes and thus the overall decrease of DOC and metal concentration in peat porewaters will be around 20 to 30%. The average rate of peat formation in Siberian flat-mound bogs is 0.24 mm y^{-1} (Inisheva et al., 2013). Taking into account the climate warming and accelerated peat growth, after 500 to 1000 years which are necessary to form the new ca. 20-cm peat layer, the second scenario will take over and thus up to 2-fold cumulative element concentration decrease in soil fluids of continuous permafrost zone may occur.

Inisheva, L. I., Kobak, K. I., Turchinovich, I. E.: Evolution of the paludification process, and carbon accumulation rate in bog ecosystems of Russia, Geography Natural Resources, 34 (3), 246–253, doi:10.1134/S1875372813030086, 2013.

- *line 481: you write "proportion of mounds between 20 and 50%", is that a proportion of the total landscape? Or a proportion of the total elements? Please explain.* This is the proportion of the total terrestrial landscape. The territory includes frozen bogs composed of mounds (hummocks) and hollows/depressions and thermokarst lakes. The typical proportion of mounds in the terrestrial landscape of the WSL (35±15%, Novikov et al., 2009 and authors' unpublished data). Specifically, we calculated the micro-landscape forms at the Khanymey site as following: lakes, 53%; mounds, 23%; hollows, 10% and depressions, 14%. Without considering lakes, the mounds, hollows and depressions occupy 49, 21 and 30% of the territory, respectively. Detailed discussion of possible evolution of the micro-landscape will be a subject of another publication.

- *line 490-492: the fact that this study contradicts a dominating paradigm is something that can come forward a bit more, in my opinion, such as in the conclusions and/or in the abstract.* We agree on this remark: the dominating paradigm of the increase of DOC, DIC, major cation and metal export fluxes upon the on-going climate warming in boreal and subarctic regions should be revised for the case of frozen peatlands.

- *is there a reason why you measured $SUVA_{280}$ and not the more commonly used $SUVA_{254}$?* The UV absorbance of the filtered samples was measured at 280 nm using quartz 10-mm cuvette on Cary-50 spectrophotometer. The specific UV-absorbency at 280 nm ($SUVA_{280}$, L mg^{-1} m^{-1}) is used as a proxy for aromatic C, molecular weight and source of DOM (Uyguner and Bekbolet, 2005; Weishaar et al., 2003; Ilina et al., 2014 and references therein). The main reason of using $SUVA_{280}$ instead of $SUVA_{245}$ or $SUVA_{254}$ in the present study is for consistency with numerous previous measurements of lakes and rivers in western Siberia (Shirokova et al., 2013; Manasypov et al., 2015, 2017; Pokrovsky et al., 2015) and permafrost-draining rivers in Central Siberia (Prokushkin et al., 2011). More importantly, there is a strong and linear relationship between the absorption at various UV-range wavelength in western Siberian surface waters as shown in **Figure 3R** of our reply to **Reviewer No 2** (http://www.biogeosciences-discuss.net/bg-2017-24/bg-2017-24-AC1-supplement.pdf). Overall, we believe that the $SUVA_{280}$ can adequately represent the optical properties of DOM in WSL peat porewaters.

Tables and figures: - Table 1: write "latitude" instead of "GPS", and perhaps add the abbreviations for the regions (Tz, Ur, etc.) behind the site names. We agree and corrected accordingly.

- *Figure 1: I think the panel with the actual map can be improved for increased readability, for example: enlarge picture, add either a vegetation map or biome map, or permafrost zonation map (instead of red lines) on the background (instead of the currently-used rather vague colours). Additionally, is it possible to add site maps with more detailed, high-res sampling locations of the different samples?* We greatly revised the maps in Figure 1 following this important remark as shown in Fig 1R of this reply. Now this figure includes the biome boundaries and permafrost zonation map. However, adding detailed sampling locations at the key sites would greatly overload this paper. Besides, the sampling was performed in a relatively small area in each site, which is much better shown via actual aerial images in Fig. 1 than via rather complicated topographical maps. Finally, high–resolution (1:25,000-1:10,000) maps necessary for showing out study sites of these territories are simply not yet available.

- *Figure 2: What is the vertical white line (with a dashed line in it) that crosses panel B through the left polygon?* This vertical line indicated a discontinuity of hydrological flow-path.

- Figure 3, 4, and 5: write "linear" instead of "liner". Also, it may be good to indicate the boundaries between the sporadic-discontinuous and discontinuous-continuous permafrost zones with vertical thin dashed lines? Following this important advice, we revised Figure 3, 4 and 5 as shown in our reply to **Reviewer No 2** (http://www.biogeosciences-discuss.net/bg-2017-24/bg-2017-24-AC1-supplement.pdf)

Text edits/spelling:

- *Title: write "elements" instead of "element"?* Agree and corrected

- *line 55: "arctic" line 156: "landscapes"* Corrected

- *line 211: "pore waters"* Corrected

- *I personally think ALT "rise" is not an ideal way of putting it, I would prefer to use ALT deepening or ALT thickening.* We agree that it is better to say “ALT deepening” or “ALT thickening” and corrected this term throughout the manuscript

Line 305-307: add "respectively" after this sentence Corrected

- *line 440: I suggest to write "our obtained results"* Corrected

- line 450: "in accordance" Corrected

- line 464 and 466: "on the one hand" and "on the other hand" (not "from") Corrected

- *Olefeldt should be spelled throughout the manuscript with "dt"* Corrected throughout the manuscript

In general, the language is quite good but I think the manuscript can benefit from a quick native-speaker check because particularly the use of articles ("the" and "a) is often left out where it is required, and sometimes vice versa. We carefully proofread manuscript for English grammar and spelling and took into account all grammar remarks of both reviewers. Please note that English corrections are included in Biogeosciences service of open access articles should this paper be considered for publication in BG.

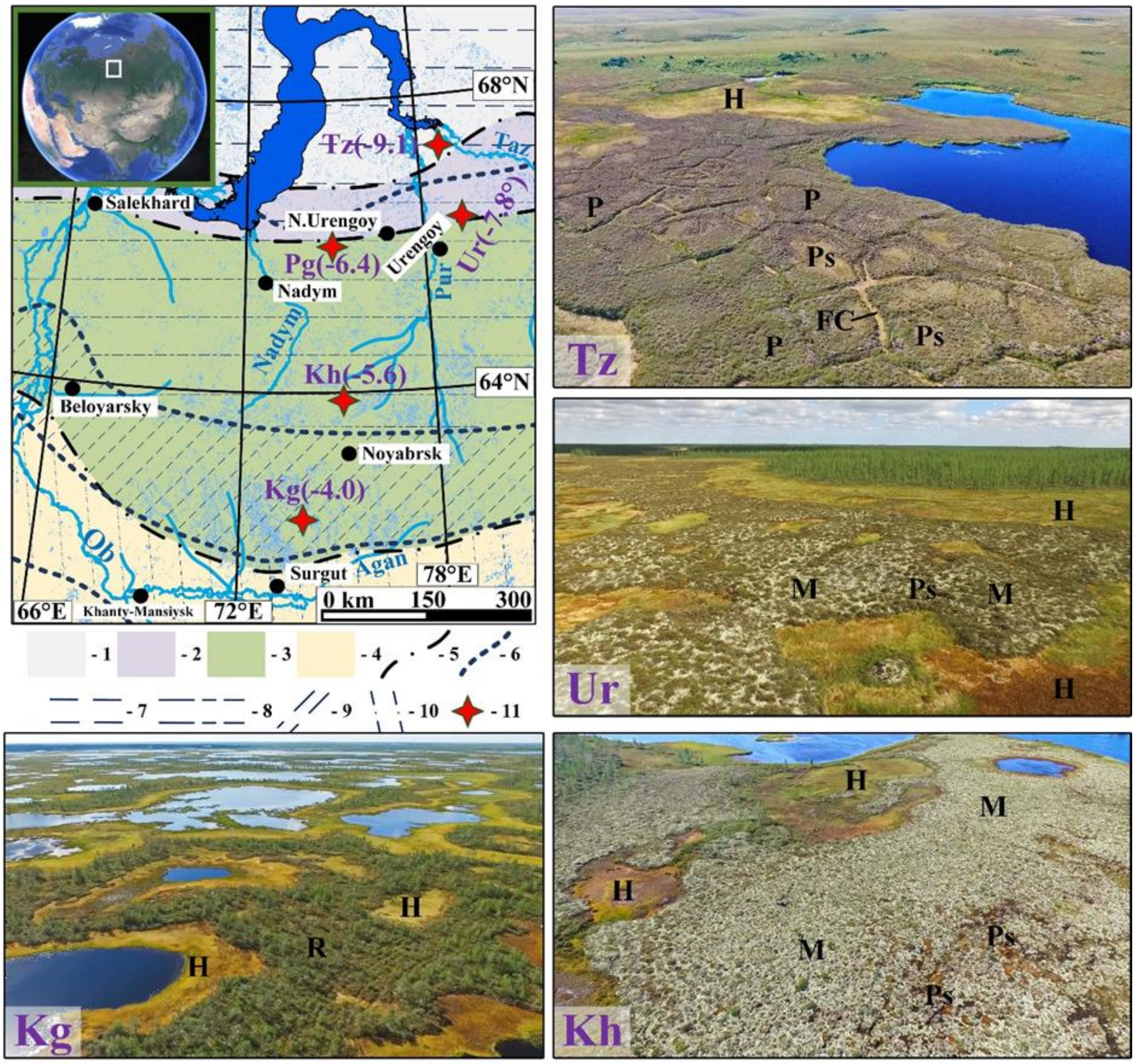

Figure 1R. Map of the study site with permafrost boundaries (Brown et al., 2001; http://portal.inter-map.com (NSIDC)), with 5 main test sites: Kogalym (Kg), Khanymey (Kh), Pangody (Pg), Urengoy (Ur) and Tazovsky (Tz). The mean annual temperatures are given in parenthesis. The inserts represent aerial (drone-made) photos of main sites with the position of mound/polygon (M/P), hollow (H), frost crack (FC) and permafrost subsidence (Ps). On the Kogalym site, a hollow (H) – ridge (R) – lake complex is dominating landscape type.

The numbers on the legend represent the following: 1, tundra; 2, forest-tundra; 3, northern taiga; 4, middle taiga; 5, borders between natural biomes; 6, borders between permafrost zones; 7, continuous permafrost; 8, discontinuous permafrost; 9, sporadic permafrost; 10, isolated permafrost; 11, key study sites with mean annual temperature is in the parentheses.